

Docket No.: 50103-421

PATENT

1773
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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DEC 08 2003
TC 1700

In re Application of : Customer Number: 20277
Wen LIU, et al. : Confirmation Number: 6031
Serial No.: 09/986,863 : Group Art Unit: 1773
Filed: November 13, 2001 : Examiner: STEVAN A RESAN

For: ULTRA-THIN, CORROSION-RESISTANT, HYDROGENATED CARBON
OVERCOATS BY COMBINED SPUTTERING AND PECVD

TRANSMITTAL OF APPEAL BRIEF

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith in triplicate is Appellant(s) Appeal Brief in support of the Notice of Appeal filed concurrently herewith. Please charge the Appeal Brief fee of \$330.00 to Deposit Account 500417.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT, WILL & EMERY

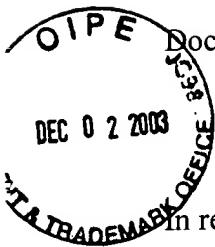
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APPEAL BRIEF

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Commissioner for Patents
PO. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is submitted in support of the Notice of Appeal filed concurrently herewith.

I. REAL PARTY IN INTEREST

The real party in interest is Seagate technology LLC.

II. RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any related appeals and interferences.

III. STATUS OF CLAIMS

Claims 1 – 26 are pending in this application. Of these, claims 7 – 15 and 23 – 25 stand withdrawn from consideration as a result of a requirement for restriction. Accordingly, claims 1 – 6, 16 - 22, and 26 are active, with claims 1, 16, and 26 being independent. Claims 1 – 6, 16 -22, and 26

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stand finally rejected (Official Action dated September 5, 2003, paper no. 6). It is from the final rejection of claims 1 – 6, 16 - 22, and 26 that this appeal has been taken.

IV. STATUS OF AMENDMENTS

No amendment has been made to the claims subsequent to the amendment to claim 26 contained in appellants' response to the Official Action dated March 18, 2003 (non-final 1st rejection, paper no. 4).

V. SUMMARY OF INVENTION

The claimed invention, per independent claims 1, 16, and 26, is directed to a novel hard, abrasion *and* corrosion-resistant material useful as a protective overcoat layer for a magnetic or magneto-optical (MO) recording medium, and to recording media comprising the novel hard, abrasion *and* corrosion-resistant material as a protective overcoat layer, wherein the novel material comprises a hydrogenated carbon (C:H) material formed by a novel process comprising *simultaneous* sputter *and* plasma-enhanced chemical vapor deposition (PECVD) of the C:H material, *and* wherein the amount of carbon (C) atoms in the C:H material derived from the PECVD component of the process is less than about 50 at. %.

The various dependent claims further specify the amount of C atoms in the C:H material derived from the PECVD component of the process at least about 30 at. % (claims 2 and 17), the position of the Raman G-band of the C:H material at about 1553 cm⁻¹ (claims 3 and 18), the film resistance of the C:H material as high as about 85 kΩ (claims 4 and 18), and the thickness of the C:H material when forming a protective overcoat layer of a recording medium as not greater than about 30 Å (claims 6 and 21).

In addition, dependent claim 22 and independent claim 26 specify the recording medium as including at least one ferromagnetic layer comprising cobalt (Co).

The invention addresses and solves problems associated with the shortcomings and disadvantages of carbon-containing materials formed by a variety of techniques and intended to be utilized as protective overcoat layers for thin-film magnetic and magneto-optical (MO) recording media employed in disk drives under contact start/stop (“CSS”) operation. Specifically, as described in the instant specification (page 2, line 11 to page 5, line 20):

“Thin film magnetic recording media are conventionally employed in disk form for use with disk drives for storing large amounts of data in magnetizable form. Typically, one or more disks are rotated on a central axis in combination with data transducer heads. In operation, a typical contact start/stop (CSS) method commences when the head begins to slide against the surface of the disk as the disk begins to rotate. Upon reaching a predetermined high rotational speed, the head floats in air at a predetermined distance from the surface of the disk due to dynamic pressure effects caused by air flow generated between the sliding surface of the head and the disk. During reading and recording operations, the transducer head is maintained at a controlled distance from the recording surface, supported on a bearing of air as the disk rotates, such that the head can be freely moved in both the circumferential and radial directions, allowing data to be recorded on and retrieved from the disk at a desired position. Upon terminating operation of the disk drive, the rotational speed of the disk decreases and the head again begins to slide against the surface of the disk and eventually stops in contact with and pressing against the disk. Thus, the transducer head contacts the recording surface whenever the disk is stationary, accelerated from the static position, and during deceleration just prior to completely stopping. Each time the head and disk assembly is driven, the sliding surface of the head repeats the cyclic sequence consisting of stopping, sliding against the surface of the disk, floating in the air, sliding against the surface of the disk, and stopping.

As a consequence of the above-described cyclic CSS-type operation, the surface of the disk or medium surface wears off due to the sliding contact if it has insufficient abrasion resistance or lubrication quality, resulting in breakage or damage if the medium surface wears off to a great extent, whereby operation of the disk drive for performing reading and reproducing operations becomes impossible. The protective overcoat layer is formed on the surface of the polycrystalline magnetic recording medium layer so as to protect the latter from friction and like effects due to the above-described sliding action of the magnetic head. Abrasion-resistant, carbon (C)-containing protective coatings have been utilized for this purpose, and are typically formed by sputtering of a carbon target in an argon (Ar) atmosphere. Such amorphous carbon (a-C)-containing protective overcoat layers formed by sputtering have relatively strong graphitic-type bonding, and therefore exhibit a low coefficient of friction in atmospheres containing water (H_2O) vapor, which characteristic is peculiar to graphite. However, the a-C layers produced in such manner have very low hardness as compared with many ceramic materials such as are employed as slider materials of thin film heads, and thus are likely to suffer from wear due to contact therewith.

In recent years, therefore, carbon-based protective overcoat layers having diamond-like hardness properties (i.e., HV of about 1,000-5,000 kg/mm²) have been developed, and films of diamond-like carbon (DLC) having a high percentage of diamond-type C-C bonding have been utilized. Such DLC films exhibit a high degree of hardness due to their diamond-like sp³ bonding structure, and in addition, exhibit the excellent sliding properties characteristic of carbon, thus affording improved sliding resistance against sliders composed of high hardness materials. Such DLC films are generally obtained by DC or RF magnetron sputtering of a carbon target in a gas atmosphere comprising a mixture of Ar gas and a hydrocarbon gas, e.g., methane, or hydrogen gas. The thus-obtained films exhibit DLC properties when a fixed amount of hydrogen is incorporated

therein. Incorporation of excessive amounts of hydrogen in the films leads to gradual softening, and thus the hydrogen content of the films must be carefully regulated.

Amorphous, hydrogenated carbon films (referred to herein as a-C:H films) obtained by sputtering of carbon targets in an Ar + H₂ gas mixture exhibiting diamond-like properties have also been developed for improving the tribological performance of disk drives; however, the electrical insulating properties of such type films lead to undesirable electrical charge build-up or accumulation during hard disk operation which can result in contamination, glide noise, etc. In order to solve this problem without sacrifice or diminution of the advantageous mechanical properties of such a-C:H films, attempts have been made to dope or otherwise incorporate nitrogen (N) atoms into the a-C:H films, in view of a substantial decrease in electrical resistivity and optical band gap (E_{BG}) exhibited by such nitrogen-doped a-C:H films relative to undoped films.

However, the continuous increase in areal recording density of magnetic recording media requires a commensurately lower flying height. Therefore, it would be advantageous to reduce the thickness of the carbon-based protective overcoat layer without adverse consequences. Conventional sputtered a-C:H materials are difficult to uniformly deposit and generally do not function satisfactorily at a thickness of about 30 Å or less. Specifically, conventional sputtered a-C:H films of about 30 Å thickness fail to provide adequate protection against corrosion of the underlying magnetic layer(s), particularly Co-containing ferromagnetic layers, when under environments of high temperature and humidity, and the resulting corrosion product(s) frequently are disadvantageously transferred to the transducer heads, often leading to failure of the disk drive.

The use of alternative deposition techniques for developing thinner and harder a-C:H layers having the requisite mechanical and tribological properties has been studied, such as chemical vapor deposition (CVD), ion beam deposition (IBD), and cathodic arc deposition (CAD) techniques. For

example, the IBD method can be utilized for forming hydrogenated ion-beam carbon films (referred to herein as i-C:H films) that exhibit superior tribological performance at thicknesses below about 100 Å. However, such films are insulating and, thus, suffer from the above-described drawback of electrical charge build-up during hard disk operation associated with sputtered a-C:H films.

Accordingly, there exists a need for an improved hard, abrasion and corrosion-resistant material particularly suitable for use as an ultra-thin protective overcoat layer in high areal density magnetic recording media, and a method for manufacturing same, which method is simple, cost-effective, and fully compatible with the productivity and throughput requirements of automated manufacturing technology.

The present invention fully addresses and solves the above-described problems attendant upon the formation of ultra-thin, abrasion and corrosion-resistant protective overcoat layers suitable for use with high areal density magnetic recording media, such as are employed in hard drive applications, while maintaining full compatibility with all mechanical and electrical aspects of conventional disk drive technology. In addition, the present invention enjoys utility in the formation of ultra-thin, abrasion and corrosion-resistant protective overcoat layers required in the manufacture and use of thin film-based, ultra-high recording density magneto-optical (MO) data/information storage and retrieval media in disk form and utilizing conventional Winchester disk drive technology with laser/optical-based read/write transducers operating at flying heights on the order of a few micro-inches above the media surface.”

Thus, the present invention has been made with the express object of obviating the disadvantages/drawbacks associated with conventionally obtained (e.g., sputtered) C:H films and the electrically insulating nature of IBD C:H films. Specifically, according to the present invention, hard, abrasion-resistant, C:H films with film resistances up to about 85 k Ohms (i.e., *lower* than that

of IBD C:H films) and eminently suitable for use as protective overcoat layers for thin film recording media, are made by an entirely different process involving simultaneous sputtering and plasma-enhanced chemical vapor deposition ("PECVD") of the C:H material. As a consequence, the deposited films contain C atoms from two distinct sources, or alternatively, are composed of two distinct types, i.e., sputter-deposited C atoms and PECVD-deposited C atoms. Very significantly, appellants have determined that the properties/characteristics of the sputtered + PECVD deposited C:H films are strongly dependent upon the relative amounts of each type of C atom present in the film.

Specifically, optimal properties of the sputtered + PECVD deposited films are obtained when the amount of C atoms in the deposited C:H film or layer derived from the PECVD component of the simultaneous sputtering + PECVD process is at least about 30 at. % but less than about 50 at. %, as described in the present specification at page 16, line 6 to page 18, line 5:

"FIG. 3 is a graph for illustrating the variation of the position of the Raman G-band of C:H films formed by the simultaneous sputtering + PECVD method of the invention, as a function of the amount of C atoms (in at. %) contributed by the PECVD component of the deposition process (at a fixed Ar flow rate); and FIG. 4 is a graph for illustrating the variation of the resistance of 25 Å thick C:H films formed by the simultaneous sputtering + PECVD method of the invention, as a function of the amount of C atoms (in at. %) contributed by the PECVD component of the deposition process. As is apparent from these figures, the C:H film properties may be varied by adjusting the C atom contribution from the PECVD component of the process. For example, FIG. 3 shows that the position of the Raman G-band is lowered as the % C atom contribution from the PECVD component increases to about 50 at. %, thereby indicating that the films have an increased amount of diamond-like sp^3 bonding providing increased hardness; and FIG. 4 indicates that the film

resistance increases with increased % C atom contribution from the PECVD component of the process, up to about 50 at. %, with further increase in % C atom contribution from the PECVD component of the process not resulting in any further increase in film resistance. In either instance, it is apparent that the % C atom contribution from the PECVD component of the process should not exceed about 50 at. %.

FIG. 5 is a graph for illustrating the variation of the % glide failure due to surface marks of C:H films formed by the simultaneous sputtering + PECVD method of the invention, as a function of the % thickness of the C:H films contributed by the PECVD component of the deposition process. As indicated above, when the contribution of C atoms to the C:H films from the PECVD component exceeds about 50 at. %, a net deposition of non-conductive hydrocarbon will occur on the surface of the carbon target, leading to arcing which tends to introduce defects in the surface of the C:H layer deposited on the substrate (i.e., media) surface. Such defects are termed "surface marks". As is clearly evident from FIG. 5, it is critical for obtainment of 0 % glide failures due to presence of such surface marks that the percentage of the film thickness attributed to the C atom contribution to the C:H films from the PECVD component of the process be limited to less than 50 %.

FIG. 6 is a graph for comparing the resistance to corrosion of Co films provided by C:H protective overcoat layers formed according to the simultaneous sputtering + PECVD method of the invention and formed according to conventional sputtering methodology, as a function of the thickness of the C:H protective overcoat layers. The data points shown FIG. 6 were obtained in the following manner: High resolution ESCA spectra were taken over the Co(2p) regions in order to determine the oxidation state of the Co. The binding energies, chemical binding state assignments, and relative percentages of CoO_x were determined for samples subjected to environmental stressing

under an 80 °C/80 % RH (relative humidity) environment for 4 days. The ESCA measurements were conducted on samples with various C:H layer thicknesses. Below a critical thickness, the C:H films lost capability of protecting the underlying Co-containing ferromagnetic layer from oxidation, i.e., CoO_x formation initiates. The critical thickness is useful measure of corrosion resistance of the film. Specifically, for a given C:H film thickness, a C:H film with a lower critical thickness provides greater corrosion/oxidation protection of the underlying Co film than a C:H film with a greater critical thickness. As is apparent from FIG. 6, the critical thickness for C:H films formed by the simultaneous sputter + PECVD method according to the present invention is 5 Å lower than that for conventional sputtered C:H films, indicating that the former C:H films provide a greater degree of corrosion protection to the underlying Co films than the latter C:H films.

Thus, the present invention provides a number of advantages over the conventional sputter-deposited C:H materials, films, and layers currently available for use as abrasion and corrosion-resistant protective overcoat layers for magnetic and MO recording media, such as hard disks. More specifically, the simultaneous sputter + PECVD-deposited C:H films according to the present invention provide enhanced corrosion resistance at ultra-thin thicknesses (i.e., ~ 30 Å), and thus are eminently suitable for use in the manufacture of very high areal recording density media and devices therefor requiring operation of read/write transducers at extremely low flying heights.”

In summary, FIG. 3 of the application indicates that C:H films with a desired amount of sp^3 bonding, as reflected by the position of the Raman G-band peak, can be obtained by varying the amount of the C atoms in the C:H films derived from the PECVD component of the process to within about 30 to about 50 at. %; FIG. 4 indicates that the electrical resistance of C:H films can be selected to be within an optimal range by similarly varying the amount of the C atoms in the C:H films derived from the PECVD component of the process to within about 30 to about 50 at. %; FIG.

5 indicates that glide failures (in CSS operation) of magnetic disks due to surface marks is reduced to zero when the amount of the C atoms in the C:H films derived from the PECVD component is less than about 50 at. %; and FIG. 6 indicates that a 5 Å lower critical thickness for corrosion protection of recording media under high humidity, high temperature conditions is provided by the simultaneous sputter + PECVD deposited C:H films of the instantly claimed invention.

VI. ISSUES

A. The Rejections

Claims 1 – 5 and 16 – 22 stand finally rejected under 35 USC § 102 (b) as “clearly anticipated” by Mahoney et al. U.S. Pat. 6,086,962 “for the reasons of record”. (NOTE: “22” appears to be in error; the rejection stated in the 1st Official Action (paper no. 4, dated March 18, 2003) refers to claims 1 – 5 and 16 – 22 as “clearly anticipated” by Mahoney et al. U.S. Pat. 6,086,962. Consequently, the following will refer to claims 1 – 5 and 16 – 20).

Claims 6 and 21 – 22 stand finally rejected under 35 USC § 103 (a) as “unpatentable” over Mahoney et al. “for the reasons of record”.

Claim 26 stands finally rejected under 35 USC § 102 (b) as “clearly anticipated” by Usuki et al. U.S. Pat. 5,869,186 “for the reasons of record”.

B. The Issues Which Arise in This Appeal and Require Resolution by the Honorable Board are:

Whether Claims 1 – 5 and 16 – 20 are unpatentable under 35 USC § 102 (b) for anticipation by Mahoney et al. U.S. Pat. 6,086,962.

Whether claims 6 and 21 – 22 are under 35 USC § 103 (a) as unpatentable for obviousness in view of Mahoney et al.

Whether claim 26 is unpatentable under 35 USC § 102 (b) for anticipation by Usuki et al. U.S. Pat. 5,869,186.

VII. GROUPING OF CLAIMS

The appealed claims do not stand or fall together. Specifically, appellants exercise their right to argue the patentability of claims 1 – 5 and 16 – 20 as a first group, claims 6 and 21 – 22 as a second group, and claim 26 as a third group.

VIII. THE ARGUMENT

A. The Examiner's Position

1. The 35 USC § 102 (b) rejection of claims 1 – 5 and 16 – 20:

In stating the basis for rejection for anticipation of claims 1 – 5 and 16 - 20 predicated on Mahoney et al., the Examiner referred to Table 3, Run 418-10 and, in essence, opined that the prior art product disclosed in Table 3, Run 418-10 of the reference is “substantially identical in structure or in composition” to the claimed products, whereby “a case of anticipation or a prima facie case of obviousness has been established and the burden of proof is shifted to applicant to show that [the] prior art products do not necessarily or inherently possess the characteristic of a claimed product, whether the rejection is based upon ‘inherency’ under 35 USC 103 or on ‘prima facie obviousness’ under 35 USC 103 jointly or alternately”. In addition, the Examiner quoted *In re Spada*, 911 F.2d 705, 709, 15 USPQ 2d 1655 (Fed. Cir. 1990) for the proposition “When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not” (underlining added for emphasis).

2. The 35 USC § 103 (a) rejection of claims 6 and 21 – 22:

In stating the basis for rejection of claims 6 and 21 – 22 for obviousness predicated on Mahoney et al., the Examiner opined that “it would have been obvious to one of ordinary skill in the art to optimize thickness” of the C:H layer “as taught by the prior art (See Mahoney et al. Col. 3,

lines 21 - 27". The Examiner further opined that it "would have been obvious to one of ordinary skill in the art to select a cobalt alloy in order to achieve high-density recording".

3. The 35 USC §102 (b) rejection of claim 26:

In stating the basis for rejection of claim 26 for anticipation predicated upon Usuki et al., the Examiner opined that the "means disclosed by Usuki et al. is deemed an equivalent means for protecting a Co magnetic layer", citing Col. 14, lines 1 – 12 and Table 2 of Usuki et al.

B. Appellant's Position

1. The 35 USC § 102 (b) rejection of claims 1 – 5 and 16 – 20:

The rejection of claims 1 – 5 and 16 – 20 for anticipation predicated upon Mahoney et al. is traversed as improper, unwarranted, and untenable for the following reasons:

The Examiner relies upon data contained in Table 3, Run 418-10 of Mahoney et al. for positing that the C:H product of that run inherently possesses or renders obvious all of the characteristics or properties possessed by the instantly claimed materials and recording media comprising the material as a protective overcoat layer. While the Examiner does not point to a specific item in the Table, or offer any elaboration as to the basis for alleging anticipation via inherency, appellants can only infer that the Examiner bases his conclusion of anticipation via inherency on the closeness of the peak value of the Raman G-band of the C:H product material listed as Run 418-10 in Table 3 of Mahoney et al., i.e., 1554 cm^{-1} , to that of the instantly claimed C:H materials, i.e., about 1553 cm^{-1} .

However, the Examiner's apparent conclusion that the similarity in position of the Raman G-band peak constitutes a "sound basis for believing that the products of the applicant and the prior art are the same" (as stated in *In re Spada*, cited by the Examiner in support of the rejection) is misplaced and in error, for the following reasons. The position of the Raman G-band peak is

indicative only of the amount of diamond-like sp³ bonding of the reference and instantly claimed C:H films, and is not indicative of similarity of various other pertinent properties of C:H films, e.g., electrical resistance, corrosion resistance, tribological properties, etc. For example, films of significantly different densities, e.g., porous and non-porous films, may have the same amount, i.e., percentage, of sp³ bonding, but widely different amounts of atoms (i.e., C atoms) with sp³ bonding/unit volume, hence completely different properties.

As a consequence, it is strongly urged that reliance upon similarity of a single property or characteristic of the reference and instantly claimed films and/or products for providing "a sound basis" for alleging that all of the disclosed and claimed properties or characteristics of the subject films or products are inherent in the reference product (listed as Run 418-10 in Table 3 of Mahoney et al.) is untenable, unsupported, and improper.

Moreover, the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993). "Inherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999).

Further, the Examiner has failed to adequately identify a factual basis for predicated the conclusion that the alleged inherency of the material necessarily flows from the relied upon Run 418-10 in Table 3 of Mahoney et al. *Finnegan Corp. v. ITC*, 180 F.3d 1354, 51 USPQ 2d 1001 (Fed. Cir. 1999) and *Ex parte Schricker*, 56 USPQ 2d 1723, 1725 (BPAI 2000).

Clearly, the Examiner's assertion that the prior art and instantly claimed C:H films are inherently the same (i.e., with respect to all relevant properties or characteristics) is without basis or merit.

More specifically, the Examiner's analysis appears to disregard the clear teachings of appellants regarding the shortcomings and disadvantages of ion beam-deposited ("IBD") C:H films when utilized as protective overcoat layers for thin film recording media, as described at page 4, line 25 to page 5, line 2:

"The use of alternative deposition techniques for developing thinner and harder a-C:H layers having the requisite mechanical and tribological properties has been studied, such as chemical vapor deposition (CVD), ion beam deposition (IBD), and cathodic arc deposition (CAD) techniques. For example, the IBD method can be utilized for forming hydrogenated ion-beam carbon films (referred to herein as i-C:H films) that exhibit superior tribological performance at thicknesses below about 100 Å. However, such films are insulating and, thus, suffer from the above-described drawback of electrical charge build-up during hard disk operation associated with sputtered a-C:H films."

By contrast, the present invention has been made with the express object of obviating the disadvantages/drawbacks associated with conventional sputtered C:H films and the electrically insulating nature of IBD C:H films. Specifically, according to the present invention, hard, abrasion-resistant, C:H films with film resistances up to about 85 kΩ (i.e., lower than that of IBD C:H films) and eminently suitable for use as protective overcoat layers for thin film recording media, are made by an entirely different process involving simultaneous sputtering and plasma-enhanced chemical vapor deposition ("PECVD") of the C:H material. As a consequence, the deposited films contain C atoms from two distinct sources, or alternatively, are composed of two distinct types, i.e., sputter-deposited C atoms and PECVD-deposited C atoms. Very significantly, applicants have determined

that the properties/characteristics of the sputtered + PECVD deposited C:H films are strongly dependent upon the relative amounts of each type of C atom present in the film.

Specifically, optimal properties of the sputtered + PECVD deposited films are obtained when the amount of C atoms in the deposited C:H film or layer derived from the PECVD component of the simultaneous sputtering + PECVD process is at least about 30 at. % but less than about 50 at. %.

For example, FIG. 3 indicates that C:H films with a desired amount of sp^3 bonding, as reflected by the position of the Raman G-band peak, can be obtained by varying the amount of the C atoms in the C:H films derived from the PECVD component of the process to within about 30 to about 50 at. %; FIG. 4 indicates that the electrical resistance of C:H films can be selected to be within an optimal range by similarly varying the amount of the C atoms in the C:H films derived from the PECVD component of the process to within about 30 to about 50 at. %; FIG. 5 indicates that glide failures of magnetic disks due to surface marks is reduced to zero when the amount of the C atoms in the C:H films derived from the PECVD component is less than about 50 at. %; and FIG. 6 indicates that a 5 Å lower critical thickness for corrosion protection of recording media under high humidity, high temperature conditions is provided by the simultaneous sputter + PECVD deposited C:H films of the instantly claimed invention.

Since the Examiner's analysis/comparison of the prior art and instantly claimed C:H films fails to take into account or otherwise establish that the prior art C:H films are composed of C atoms derived from sputtering of a carbon target and from PECVD of a hydrocarbon gas, wherein the amount of C atoms in the deposited films derived from the PECVD component is less than about 50 at. %, it is respectfully urged that the Examiner's initial burden of establishing anticipation *via*

inherency has not been carried forth, and the burden of showing same therefore remains with the Examiner.

2. The 35 USC § 103 (a) rejection of claims 6 and 21 – 22:

The rejection of claims 6 and 21 – 22 for obviousness predicated upon Mahoney et al. is traversed as improper, unwarranted, and untenable because dependent claims 6 and 21 – 22 contain at least the limitations of respective independent claims 1 and 16, and are urged as allowable for the reasons given above with respect to claims 1 and 16.

3. The 35USC § 102 (b) rejection of claim 26:

The rejection of claim 26 for anticipation predicated upon Usuki et al. is traversed as improper, unwarranted, and untenable for the following reason:

Claim 26, as amended in appellants' response to the 1st Official Action (paper no. 5, filed June 18, 2003), specifies the means for protecting a Co-containing ferromagnetic thin film layer from corrosion under high temperature, high humidity environments as comprising a layer of a hard, abrasion and corrosion-resistant material comprising hydrogenated carbon (C:H) formed by a process comprising simultaneous sputter and plasma-enhanced chemical vapor (PECVD) deposition of the hydrogenated carbon (C:H) material, wherein the amount of carbon atoms in the C:H material contributed by the PECVD component of the process is less than about 50 at. %.

As has been indicated above, FIG. 6 demonstrates that a 5 Å lower critical thickness for corrosion protection of recording media under high humidity, high temperature conditions is provided by the simultaneous sputter + PECVD C:H films of the instantly claimed invention. Specifically, when C:H films are below a critical thickness, they lose the capability of protecting underlying Co-containing ferromagnetic films layers from oxidation, i.e., CoOx formation initiates. The critical thickness is thus a useful measure of the corrosion resistance of the protective overcoat

layer, since a C:H film with a lower critical thickness provides greater corrosion/oxidation protection than a C:H film of same thickness but with a greater critical thickness. As is evident from FIG. 6, the critical thickness for C:H films formed by the inventive sputter + PECVD method is 5 Å lower than that for conventional, i.e., sputtered C:H films, indicating that they provide a greater degree of corrosion protection of the underlying Co-containing ferromagnetic films. Moreover, essentially complete corrosion protection is provided at sputter + PECVD C:H film thicknesses of about 18 Å.

Since Usuki et al. do not disclose or remotely suggest magnetic recording media with a sputter + PECVD-deposited C:H corrosion protective layer, wherein the amount of C atoms contributed by the PECVD component of the deposition process is less than about 50 at. %, Usuki et al. does not in fact anticipate claim 26.

IX. CONCLUSION

Neither Mahoney et al. nor Usuki et al. disclose or render obvious the formation of a hard, abrasion and corrosion resistant material useful as an ultra-thin protective overcoat layer for magnetic and/or magneto-optical (MO) recording media *and/or* magnetic and/or magneto-optical (MO) recording media comprising a layer of same, wherein the material comprises hydrogenated carbon (C:H) formed by a process comprising *simultaneous* sputter *and* plasma-enhanced chemical vapor deposition (PECVD) of the C:H, *and* wherein the amount of carbon atoms in the C:H material derived from the PECVD component of the process is less than about 50 at. %.

Moreover, neither Mahoney et al. nor Usuki et al. disclose or render obvious the formation of a hard, abrasion and corrosion resistant C:H material useful as an ultra-thin protective overcoat layer for magnetic and/or magneto-optical (MO) recording media *and/or* magnetic and/or magneto-optical (MO) recording media comprising a layer of same, wherein the material is formed by a

combined sputter + PECVD process, *and* wherein the amount of C atoms in the C:H material derived from the PECVD component of the process is at least about 30 at. %, the position of the Raman G-band of the C:H material is about 1553 cm^{-1} , the film resistance of the C:H material is as high as about $85\text{ k}\Omega$, *and* the thickness of a protective overcoat layer formed of the C:H material is not greater than about 30 Å.

In making the rejections for anticipation (via alleged inherency) and obviousness predicated upon Mahoney et al., the Examiner has improperly concluded that all of the claimed and disclosed advantageous properties of the combined sputter + PECVD material are inherent in the material identified as Run 418-10 in Table 3 of Mahoney et al., based solely upon an apparent similarity of a single property, i.e., the position of the Raman G-band, and thus has not provided the requisite “sound basis” for positing inherency.

As for the rejection for anticipation based upon Usuki et al., the Examiner has not demonstrated the requisite equivalence of the means for protecting the Co-based magnetic of Usuki et al. and the instantly claimed protective means comprised of hydrogenated carbon (C:H) formed by a process comprising *simultaneous* sputter *and* plasma-enhanced chemical vapor deposition (PECVD) of the C:H, *and* wherein the amount of carbon atoms in the C:H material derived from the PECVD component of the process is less than about 50 at. %.

X. PRAYER FOR RELIEF

Appellants respectfully submit that the previously described shortcomings in the objective evidence for inherency or equivalence of the C:H or other protective overcoat materials of the applied references Mahoney et al. and Usuki et al. fatally undermine the Examiner’s stated conclusion that the C:H material and recording media of instant claims 1 – 6, 16 – 22, and 26 is anticipated or rendered obvious by Mahoney et al. and Usuki et al. via alleged inherency or

equivalence. Appellants, therefore, respectfully solicit The Honorable Board to reverse each of the Examiner's rejections under 35 USC § 102 (b) and 103 (a).

To the extent necessary, a petition for an extension of time under 37 CFR § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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APPENDIX

1. A hard, abrasion and corrosion-resistant material useful as an ultra-thin protective overcoat layer for a magnetic or magneto-optical (MO) recording medium, which material comprises hydrogenated carbon (C:H) formed by a process comprising simultaneous sputter and plasma-enhanced chemical vapor (PECVD) deposition of said hydrogenated carbon (C:H), wherein the amount of carbon atoms in said C:H material derived from the PECVD component of said process is less than about 50 at. %.

2. The material according to claim 1, wherein the amount of carbon atoms in said C:H material derived from the PECVD component of said process is at least about 30 at. %.

3. The material according to claim 1, wherein the position of the Raman G-band of the C:H material is about 1553 cm^{-1} .

4. The material according to claim 1, wherein the film resistance of the C:H material is as high as about $85\text{ k }\Omega$.

5. A magnetic or MO recording medium comprising a protective overcoat layer formed of the C:H material according to claim 1.

6. The medium according to claim 5, wherein the thickness of said protective overcoat layer is not greater than about 30 \AA .

7. A recording medium, comprising:

- (a) a substrate;
- (b) a stack of thin film layers on said substrate; and
- (c) a protective overcoat layer on an uppermost layer of said stack of thin film

layers, wherein:

said protective overcoat layer comprises a hard, abrasion and corrosion-resistant material comprising hydrogenated carbon (C:H) formed by a process comprising simultaneous sputter and

plasma-enhanced chemical vapor (PECVD) deposition of said hydrogenated carbon (C:H) material, wherein the amount of carbon atoms in said C:H material contributed by the PECVD component of said process is less than about 50 at. %.

8. The medium as in claim 16, wherein the amount of carbon atoms in said C:H material contributed by the PECVD component of said process is at least about 30 at. %.

9. The medium as in claim 16, wherein the position of the Raman G-band of the C:H material of said protective overcoat layer is about 1553 cm^{-1} and the film resistance of said C:H material of said protective overcoat layer is as high as about $85\text{ k }\Omega$.

10. The medium as in claim 16, wherein:

said stack (b) of thin film layers comprises a stack of layers for a magnetic or magneto-optical (MO) recording medium.

11. The medium as in claim 19, wherein:

said substrate (a) is disk-shaped.

12. The medium as in claim 19, wherein:

said stack (b) of thin film layers comprises a stack of layers for a magnetic recording medium; and

said protective overcoat layer (c) is not greater than about 30 \AA thick.

13. The medium as in claim 21, wherein:

said stack (b) of thin film layers includes at least one ferromagnetic layer comprising Co.

14. A magnetic recording medium, comprising:

(a) at least one ferromagnetic thin film layer containing Co; and

(b) means for protecting said at least one Co-containing ferromagnetic thin film layer from corrosion under high temperature, high humidity environments, comprising a layer of a

hard, abrasion and corrosion-resistant material comprising hydrogenated carbon (C:H) formed by a process comprising simultaneous sputter and plasma-enhanced chemical vapor (PECVD) deposition of said hydrogenated carbon (C:H) material, wherein the amount of carbon atoms in said C:H material contributed by the PECVD component of said process is less than about 50 at. %.